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(71) Applicant(s):  
**Hitachi Ltd**  
 (Incorporated in Japan)  
 6 Kanda Surugadai 4-chome, Chiyoda-ku,  
 Tokyo, Japan

(72) Inventor(s):  
**Nobutaka Okuyama**  
**Kenji Katsumata**

(74) Agent and/or Address for Service:  
**Mewburn Ellis LLP**  
 York House, 23 Kingsway, LONDON,  
 WC2B 6HP, United Kingdom

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(56) Documents Cited:  
**EP 1274238 A2** **EP 1001632 A3**  
**WO 2002/078349 A2** **WO 2002/032141 A3**  
**JP 2001101797 A** **US 20020009289 A1**

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 UK CL (Edition V) **G5R**  
 INT CL<sup>7</sup> **G11B, H04N**  
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(54) Abstract Title: **Variable bit rate video recording.**

(57) A video recording apparatus varies the bit rate of recording according to the program content and the viewer's program usage history. Less favoured programs are recorded at a lower bit rate than those usually watched. The apparatus may comprise a de-multiplexer 11 and multiple rate converters 11a - 11c so that all received programs may be recorded with only favourite programs being recorded at high bit rates thus optimising space in the recording media 13, 13'. Some programs may be recorded at high bit rate irrespective of their content, bit rates may be changed for a particular scene, and bit rate may be lowered when a commercial is detected. Detecting a lowered bit rate may allow a commercial to be skipped on reproduction. Program information may be acquired from the internet. The apparatus may further create a program guide of programs recorded, based on one or more viewers' preference.

**FIG.1**

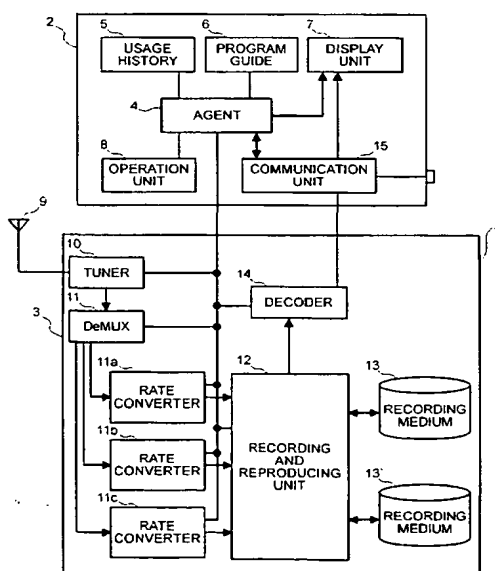
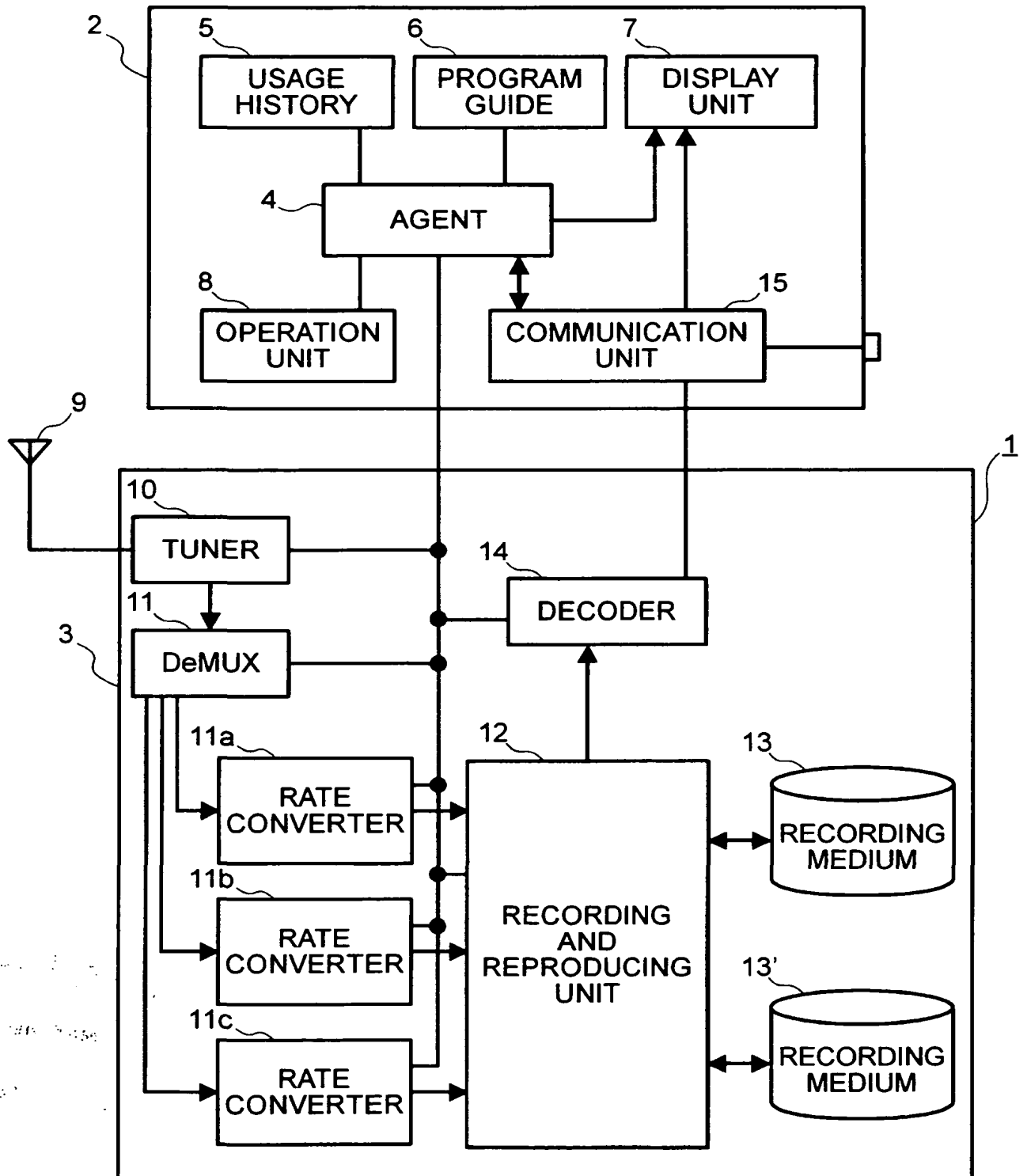


FIG.1



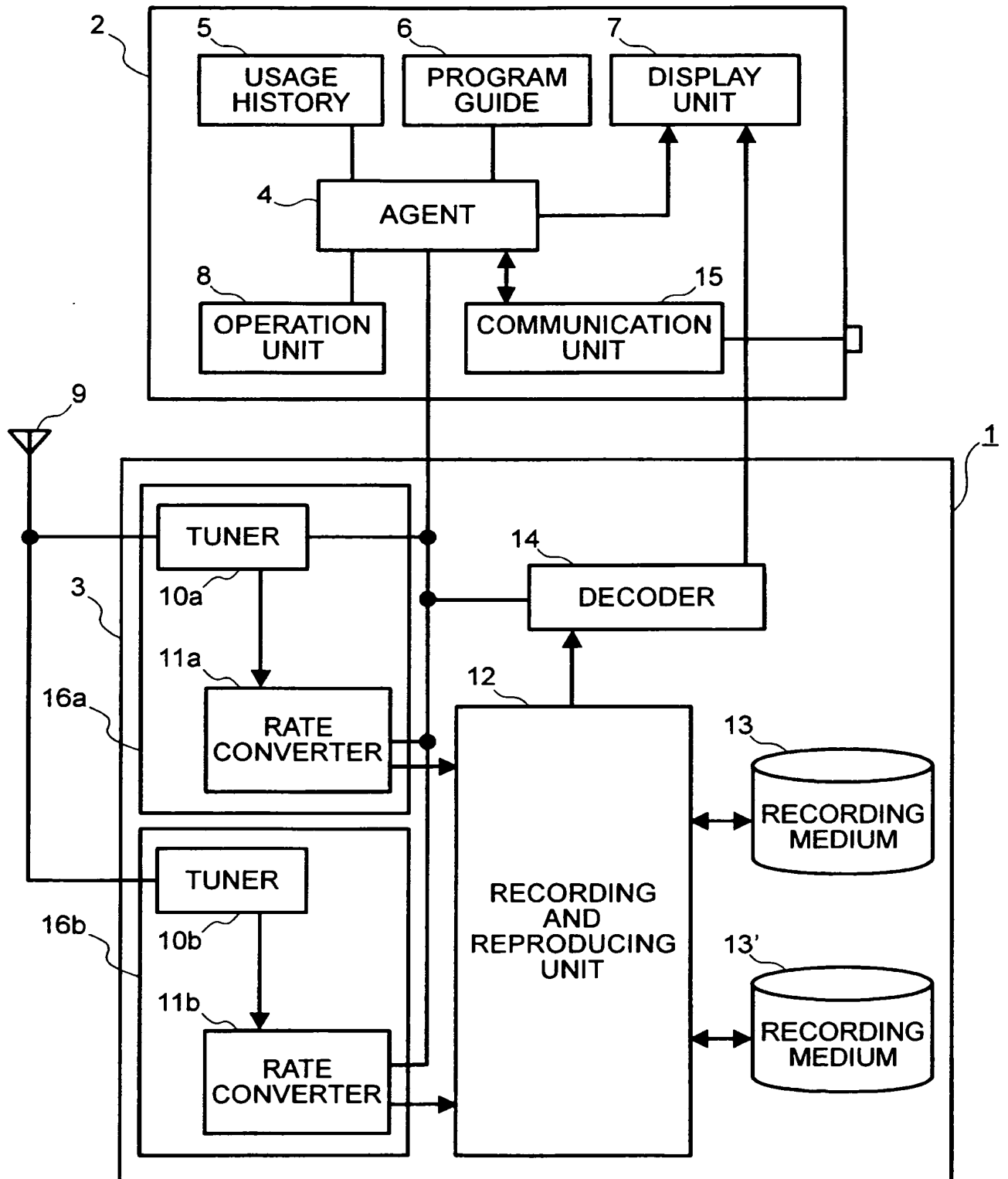
**FIG.2**

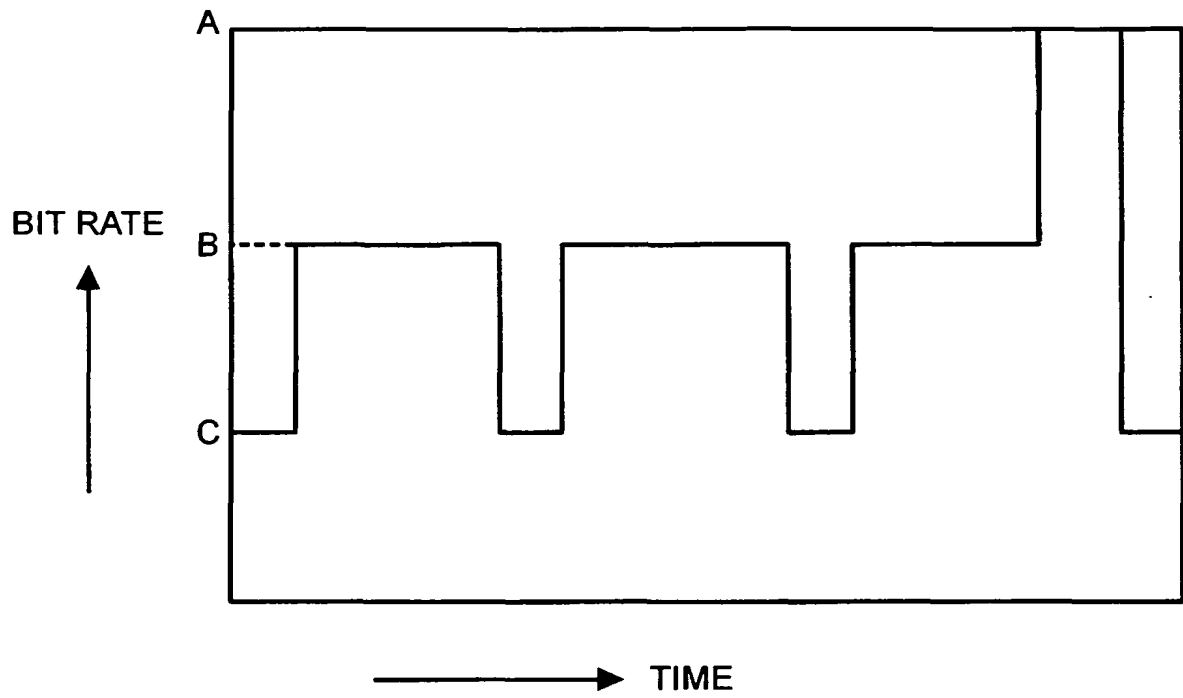
RECORDING AND REPRODUCING CONTENTS	PROGRAM	USAGE TENDENCY	VIDEO FORMAT	BIT RATE [Mbps]
OUTPUT OF RATE CONVERTER 11a	1 SPORT	60%	HDTV	20
OUTPUT OF RATE CONVERTER 11b	2 MOVIES	15%	HDTV	10
OUTPUT OF RATE CONVERTER 11c	3 NEWS	4%	SDTV	1.5
INPUT OF DECODER			SDTV	6
TOTAL				37.5

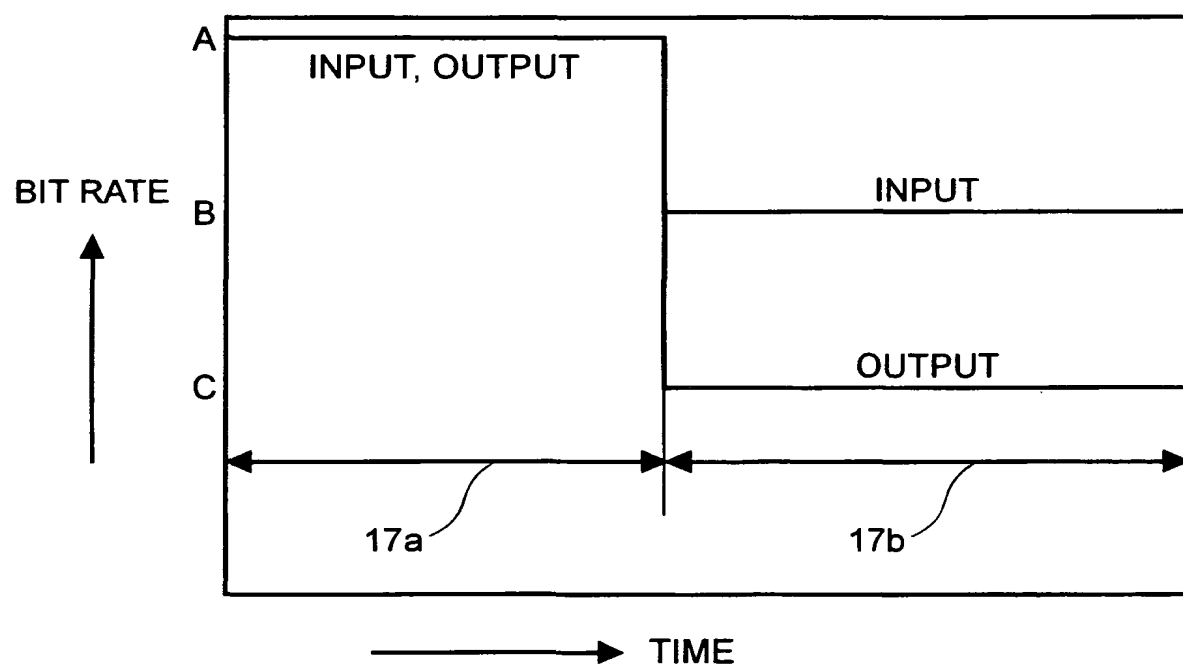
**FIG.3**

RECORDING AND REPRODUCING CONTENTS	PROGRAM	VIDEO FORMAT	BIT RATE [Mbps]
OUTPUT OF RATE CONVERTER 11a	1	HDTV	20
OUTPUT OF RATE CONVERTER 11b	1	HDTV	5
OUTPUT OF RATE CONVERTER 11c	3	SDTV	1.5
INPUT OF DECODER	1	HDTV	5
TOTAL			31.5

FIG.4



**FIG.5**

**FIG.6**

**FIG.7**

USER: FATHER

CURSOR

CATEGORY	NEWS	SPORT	DRAMA	VARIETY
RANK 1	NEWS A HD-A	BASEBALL A SD-A	DRAMA A HD-A	QUIZ A HD-A
RANK 2	NEWS B HD-B	BASEBALL B SD-A	DRAMA B HD-A	QUIZ B HD-A
RANK 3	NEWS C SD-B	SOCCER HD-B	DRAMA C HD-B	MUSIC A HD-A
RANK 4	NEWS D HD-C	GOLF HD-C	DRAMA D SD-B	MUSIC B HD-B
RANK 5	NEWS E SD-C	MARTIAL ART SD-C	DRAMA E SD-C	TALK SHOW SD-B

## RECORDING EQUIPMENT AND RECORDING METHOD

The present invention relates to recording equipment for recording input information, for example, television broadcast over a long period of time.

The conventional recording equipment, for example, as disclosed in Japanese Patent Application Laid-open No. 2000-261750, comprises main recording means for storing the received broadcast information based on the user's recording instructions and auxiliary recording means for information compressing and recording the broadcast that is being viewed, while the user is viewing the received broadcast information. Such an equipment automatically decides as to whether the recording should be made based on the category or user preferences.

Further, Japanese Patent Application Laid-open No. 8-180504 discloses the equipment for recording based on the decision



concerning the presence of a frequently received program which is made with a channel history memory.

If programs are always recorded according to a decision that is made based on the user preferences survey results or specific categories and user's recording instruction, the user will lose the opportunity to view programs of categories other than the user preferences. Further, if the entire viewable broadcast is recorded without any selection, a problem arises that there are required greatly increased storage capacity and greatly increased capacity of processing the bit rate required for the recording. It is an object of the present invention to enable the reproduction of a program matching the user preferences in a high-quality video.

The present invention provides a recording equipment comprising at least one tuner capable of receiving a broadcast of a plurality of channels and rate converters for changing a bit rate for each channel after separation when the output of the tuner includes a plurality of channels which have been multiplexed, wherein the history of the programs that have been viewed by the user is recorded as the usage history, the usage tendency of the user is extracted from the usage history with an

agent, a decision is made as to whether the program selected for each channel matches the usage tendency of the user, and in case of matching, the recording is made on a recording medium directly at a bit rate allowing the high-quality video to be maintained, whereas when the usage tendency of the user is not matched, recording is made on the recording medium upon conversion to a low bit rate.

As described above, according to the present invention, broadcasted programs can be recorded and viewed by providing a storage medium with relatively small storage capacity.

These and other features, objects and advantages of the present invention will become more apparent from the following description when taken in conjunction with the accompanying drawings wherein:

FIG. 1 is a block diagram illustrating the rate converting and recording system in accordance with the present invention;

FIG. 2 illustrates an example of bit rate distribution of video data handled by the recording and reproducing control unit in accordance with the present invention;

FIG. 3 illustrates an example of bit rate distribution of video data handled by the recording and reproducing control unit in accordance with the present invention;

FIG. 4 is a block diagram illustrating the rate converting system in accordance with the present invention;

FIG. 5 illustrates rate conversion operation of the rate converter in accordance with the present invention;

FIG. 6 illustrates a bit rate of video data input and output in the rate converter in accordance with the present invention; and

FIG. 7 illustrates a program guide for reproducing a program recorded in accordance with the present invention.

While we have shown and described several embodiments in accordance with our invention, it should be understood that disclosed embodiments are susceptible of changes and modifications without departing from the scope of the invention. Therefore, we do not intend to be bound by the details shown and described herein but intend to cover all such changes and modifications as fall within the scope of the appended claims.

An embodiment of the present invention will be described below.

FIG. 1 is a block-diagram illustrating the configuration of the rate converting system in accordance with the present invention. A rate converting system 1 is composed of a control and display unit 2 and a recording and reproducing unit 3. Further, control and display unit 2 comprises an agent 4 for controlling the entire system, an operation unit 8, a usage history 5 for managing and holding the usage information for a user, and a program guide 6 for managing and holding the program information introduced via broadcasting or communication. The program information obtained via broadcasting or communication includes the program title, category, performer, contents, and the like.

Further, the recording and reproducing unit comprises a tuner 10, a DeMUX (demultiplexer) 11 for demultiplexing the stream of digital broadcasting of the tuner output into each program or program information, a plurality of rate converters 11a, 11b, 11c, a recording and reproducing control unit 12, a recording medium 13, and a decoder 14.

In the present embodiment, the agent 4 analyzes the usage tendency of the user based on the usage history, determines the program matching the usage tendency from the program guide, passes the program matching the usage tendency through the rate converter 11a at a high bit rate and without compressing, indicates a low-bit rate with a high compression for the program

that does not match the usage tendency, converts the bit rate with rate converters 11b, 11c, and records the output thereof on recording medium 13 via recording and reproducing control unit 12. Usage history 5 is obtained by agent 4 extracting and recording the usage information (for example, category, performer, program contents, and the like) of the programs that have been used and reproduced by the user from decoder 14 or recording and reproducing control unit 12.

The program that has been recorded or is being recorded is read out from recording medium 13 into recording and reproducing control unit 12 and decoded with decoder 14, and video is thereafter displayed on display unit 7. Recording and reproducing control unit 12 thus executes recording and reproduction of a plurality of programs by multitask processing. Here, the upper limit of the bit rate handled in recording and reproducing control unit 12 may be in general no more than a total sum of bit rates of all video data handled by multitask processing.

Further, the analysis of the usage tendency of the user may be handled as a program which is simply repeated each week from the weekday and time it was used, based on the usage history. Further, a keyword of a category or performer may be extracted from the program information and the program guide may be searched by the extracted keyword. Further, the keyword can be also determined by reference to the usage history or may be set

by the user. The usage history 5 can be also recorded separately by a plurality of users. It is the user who sets which of the above-mentioned information groups will have preference. For example, some users can make settings such that great importance will be attached to the history information relating to a performer. Further, the history information may be reset according to a period in which the program of TV station is changed.

FIG. 2 illustrates an example of bit rate distribution of each video data handled by the recording and reproducing control unit. Here, agent 4 compares the data, such as keywords, and the like, recorded in the usage history 5 with the keyword contained in the program information extracted from the input program and presents the matching ratio thereof with an index. For example, because program 1 of video data from rate converter 11a is sport in a HDTV (high definition television video) format and the usage tendency of the user is high (60%), the program is output at a bit rate of 20 Mbps, without rate conversion. Program 2 of video data from rate converter 11b is movies in a HDTV format, but because the usage tendency of the user is low (15%), the program is output upon bit rate conversion from 20 Mbps to 10 Mbps. Further, program 3 of video data from rate converter 11c is news in a SDTV (standard television video) format, and because the usage tendency of the user is very low (4%), the program is

output upon conversion from 6 Mbps to a low bit rate of 1.5 Mbps. Thus, when the index is no less than 40%, no rate conversion is conducted, and when the index is 10-40%, the data is compressed to about one half. When the index is no more than 10%, the compressing ratio is determined so as to compress data to a rate of about one fourth.

On the other hand, video data of SDTV format that has already been recorded at 6 Mbps is read out from the recording medium 13. Therefore, recording and reproducing control unit 12 and recording medium 13 are required to have a capacity of processing data at least at a bit rate of 37.5 Mbps.

In the present embodiment, with the usual recording without rate conversion, a total of 46 Mbps (20 + 20 + 6) data has to be recorded, whereas recording in which the preference tendency is decided upon with the agent can reduce this amount to a total of 31.5 Mbps.

When programs of a plurality of streams are received, a plurality of sets of tuners, DeMUX, and rate converters (not shown in the figures) may be provided.

Further, rate converter 11c may also conduct transcoding from MPEG2 that was digitally broadcasted to MPEG4 or other video compressing format. In this case, the video data of MPEG 2 may be encoded from an intermediate stage of a decoder to another video compressing format, without 100% decoding.

Furthermore, when a plurality of programs identical in video and differing in audio, for example, languages, are broadcasted or when the same program is broadcasted several times in the same day with a shift in time, presetting the selection conditions will allow the program with the same video information to be recorded automatically only one time.

FIG. 3 illustrates another example of bit rate distribution of video data handled by the recording and reproducing control unit in accordance with the present invention, this example relating to a case when a user has instructed time shift reproduction of program 1. A set of bit rates during operation corresponding to FIG. 2 is also shown in this figure. Because video data from rate converter 11a is in a HDTV format and matches the usage tendency of the user, the data is output at a bit rate of 20 Mbps without rate conversion. Rate converter 11b outputs the program data identical to that of rate converter 11a upon rate conversion to 5 Mbps and the data is double recorded as video data for time shift reproduction. Furthermore, video data of program 3 from rate converter 11c is in SDTV format, but because it does not match the usage tendency of the user, it is output upon conversion from 6 Mbps to a low-bit rate of 1.5 Mbps. On the other hand, video data in the HDTV format which is being recorded at 5 Mbps is read out from recording medium 13 with a time shift. Therefore, recording and reproducing control unit 12



and recording medium 13 are required to have a capacity of processing data at least at a bit rate of 31.5 Mbps.

In the present embodiment, in case of usual time shift reproducing without double recording, 41.5 Mbps ( $20 + 1.5 + 20$ ) data has to be recorded and reproduced, whereas double recording can reduce the total bit rate of recording and reproducing to 31.5 Mbps.

A communication unit 15 and a second recording medium 13' can be provided as additional components with respect to the configuration shown in FIG. 1. With communication unit 15, program information can be input from internet and held in the program guide. Further, information indicating that the program is a recommended program is input from internet or broadcast signals and stored in the agent. When added to the video signal, the recommended program may be assigned with a priority separately from the usage tendency of the user and rate converted to a high bit rate with rate converters 11a, 11b, 11c at a low compressing rate by separating this information and storing in the agent. In the present embodiment, two recording media 13, 13' were provided. Thus providing a plurality of recording media makes it possible to enlarge the total of bit rates that can be recorded and reproduced simultaneously and to conduct long-time recording of a larger number of channels.

FIG. 4 is a block diagram of a rate converting system of the other embodiment of the present invention. Components operating identically to the components shown in FIG. 1 are assigned with identical reference symbols. In the present embodiment, a plurality of tuners 10a, 10b and a plurality of rate converters 11a, 11b for analog broadcasting are provided. The difference between this embodiment and the above-described embodiment is in that the DeMUX is not provided because no multiplexing was employed due to analog broadcasting and in that the rate converters are provided with a function of encoding from analog video signals.

Further, a configuration may be also employed in which receiving units 16a, 16b each containing one tuner and one rate converter can be attached and detached separately from each other. The advantage of the configuration composed of such receiving units is that the number of receiving units may be increased, if necessary, according to the number of channels that the user will receive at the same time and the configuration can be easily changed. Further, it is also possible to increase the number of such receiving units in the above-described configuration for digital broadcast and to conduct simultaneous recording of digital broadcast and analog broadcast.

Furthermore, when the number of channels that can receive analog broadcast is larger than the number of tuners, they can be

selected in order of priority channels that were assigned with priority based on the user preferences and recommended program, and the channel selected by a specific tuner may be changed by changing the program as time elapses.

FIG. 5 is a performance chart illustrating another example of rate conversion operation of the rate converter in accordance with the present invention. This figure illustrates a bit rate after conversion with a rate converter during one program. The bit rate C with the lowermost level represents a case when broadcasting of commercials was detected, for example, by changes in the voice mode. The bit rate B of the medium level represents a case when a usual program has been broadcasted. Further, the bit rate A of the high level represents a case when broadcasting of highlights was detected by program information. With the present embodiment, highlights of major interest can be recorded as a high-quality video. For commercials, the bit rate can be decreased and the quantity of recorded data can be reduced. Thus, if recording in the same program is conducted by taking the contents into account, then the entire quantity of data can be reduced by recording only the contents with a high priority as high-quality video and recording other contents at a low bit rate.

Further, by employing the difference in the recording bit rates, it is also possible to provide a function of conducting the reproducing operation with skipping of the next commercial

during reproduction. When using the system, the user may directly supply an instruction of changing the bit rate of recording to the operation unit.

FIG. 6 is a performance chart illustrating an example of rate conversion operation of the rate converter in accordance with the present invention. In HDTV broadcasting, the original video data is sometimes SDTV, but broadcasted as HDTV. However, in this case, the bit rate of inputting into the rate converter decreases by comparison with that in the case when the original video data is in HDTV. FIG. 6 shows the bit rate of video data input in the rate converter. In a HDTV broadcast time zone 17a, the original video data is HDTV and the average level is a high bit rate A, whereas in a time zone 17b in which SDTV video is broadcasted as HDTV, because the amount of information is small, the average level is a low bit rate B, and the difference therebetween can be recognized automatically. In the HDTV broadcast time zone 17a, output is conducted without changing the bit rate, and the average level is a high bit rate A. In the time zone 17b, converting to SDTV of the original video data automatically switches the average level to a bit rate with an average level C which is even lower than B.

Therefore, it is possible to detect automatically when a SDTV video is broadcasted as HDTV and to record a small amount of data, practically without quality degradation.

FIG. 7 shows a program guide for reproducing the program recorded in accordance with the present invention. The programs shown in the figure are separated by categories and assigned with category ranks with the usage tendency of the user. Therefore, the most appropriate program can be started merely by selecting a category according to the user's mood and usage time zone. For example, in case of news, the category rank is assigned based on the time zone and channel often viewed by the viewer, and in case of drama, the category rank is assigned based on the performance of the favorite actor of the user. When the initially displayed program does not meet the user's wishes, the program with a next category rank may be displayed by an operation similar to a channel feed, or the above-mentioned program guide may be displayed for selection. For example, in case of sport, when the user who often watches baseball decided to watch martial arts according to the mood of the day, if the cursor is moved to martial arts, the martial arts program can be immediately reproduced. Furthermore, the picture quality information and compressing rate during recording are also added. Here, HDTV format and SDTV format are distinguished, and the compressing ratio is displayed as A (no compressing), B (low compressing ratio), and C (high compressing ratio).

By opening the aforesaid usage guides separately for a plurality of users makes it possible to accumulate the preference

information for each user and to display usage guides for reproducing the recorded program matching the preferences of each user.

Further, the broadcasting in accordance with the present invention can be assumed to include not only analog and digital broadcasting, but also data or information such as streaming via a communication circuit. In such a case, an interface adapted for networking is used instated of tuner 10.

As described above, the present invention enables program recording that can be used at user's discretion.

## Claims

1. A recording equipment for recording programs containing video, comprising:
  - input terminal which inputs the programs;
  - information acquirer which acquires information relating to the programs that are input;
  - rate converter which converts the bit rate of the program that has been input;
  - recorder and reproducer which record and reproduce the program for which the bit rate has been converted with said rate converter;
  - memory which stores the information relating to the programs that were viewed by the user, among the programs that have been input; and
  - controller which conducts control so as to vary the bit rate in said rate converter based on the information stored in said memory and information acquired by said information acquirer.
2. The recording equipment according to claim 1, wherein, when an input program is recorded, said controller increases the bit rate in said rate converter as the ratio of the program matching the usage tendency of the user increases.

3. The recording equipment according to claim 1, wherein said controller ranks input programs based on the usage tendency of the user, and a program is recorded with the controller increasing the bit rate in said rate converter as the programs is ranked higher.

4. The recording equipment according to claim 1, wherein, when an input program is a specific program, the program is recorded with said controller increasing the bit rate in said rate converter, regardless of the information stored in said memory.

5. The recording equipment according to claim 1, wherein said controller detects a specific scene in one program and varies the bit rate in said rate converter based on the detected scene.

6. The recording equipment according to claim 5, wherein said specific scene is a commercial scene, and said controller records this scene, lowering the bit rate in said rate converter with respect to usual programs.

7. The recording equipment according to claim 1, wherein:



said controller controls said recorder and reproducer so that recording of a program is conducted at a first bit rate and a second bit rate which is lower than the first bit rate in said rate converter; and

the program recorded at the second bit rate is reproduced when a special operation is conducted during reproduction of the program recorded at the first bit rate.

8. The recording equipment according to claim 1, wherein said controller conducts control such that, when the original video of an input program is a high definition television video, the program is recorded with an increased bit rate in said rate converter and, when the original video of an input video signal is a standard definition television video, the program is recorded with a lowered bit rate in said rate converter.

9. The recording equipment according to claim 1, further comprising:

decoder which decodes video signal reproduced by said recorder and reproducer; and

display which displays the video signal decoded by said decoder.

10. A recording method for recording a plurality of programs that are input, comprising the steps of:

- storing the past usage information;
- inputting a plurality of programs;
- acquiring program information of the programs which are input;
- comparing the acquired program information and stored usage information;
- determining the compressing rate of recorded video signals based on the comparison results; and
- recording the video signals based on the determined compressing rate.

11. The recording method according to claim 10, further comprising the steps of:

- reproducing the recorded program; and
- displaying the reproduced program.

12. The recording method according to claim 10, wherein said acquired program information is acquired via internet.

13. A recording equipment for recording a plurality of input programs, comprising:

- input terminal which inputs a plurality of programs;

rate converter which converts the bit rate of the program that has been input;

recorder and reproducer which record and reproduce the program for which the bit rate has been converted by said rate converter based on the usage tendency of the user; and

program information creator which creates a program guide of programs recorded by said recorder and reproducer based on the usage tendency of the user.

14. The recording equipment according to claim 13, wherein information relating to the bit rate of the recorded program is added to said program guide.

15. The recording equipment according to claim 14, wherein said program information creator creates a plurality of program guides based on the usage tendencies of a plurality of users, respectively.

16. A recording equipment substantially as herein described with reference to and as illustrated in the accompanying drawings.

17. A recording method substantially as any one herein described with reference to the accompanying drawings.

**Amendments to the claims have been filed as follows**

Claims

1. A recording equipment for recording programs containing video, comprising:
  - an input terminal which receives programs from an external source;
  - an information acquirer which acquires information relating to the programs that are input;
  - a rate converter which converts the bit rate of the program that has been input;
  - recorder and reproducer which record and reproduce the program for which the bit rate has been converted with said rate converter;
  - memory which stores the information relating to the programs that were viewed by the user, among the programs that have been input;
  - a tendency analyser which analyses the usage tendency of the user based on the stored information; and
  - a controller which controls said recorder and reproducer to record the program whose bit rate was varied in said rate converter based on said analysed usage tendency and information acquired by said information acquirer.
2. The recording equipment according to claim 1, wherein, when an input program is recorded, said controller increases the bit rate in said rate converter as the ratio of the program matching the usage tendency of the user increases.
3. The recording equipment according to claim 1, wherein said controller ranks input programs based on the usage tendency of the user, and a program is recorded with the

controller increasing the bit rate in said rate converter as the program is ranked higher.

4. The recording equipment according to claim 1, wherein, when an input program is a specific program, the program is recorded with said controller increasing the bit rate in said rate converter, regardless of the information stored in said memory.

5. The recording equipment according to claim 1, wherein said controller detects a specific scene in one program and varies the bit rate in said rate converter based on the detected scene.

6. The recording equipment according to claim 5, wherein said specific scene is a commercial scene, and said controller records this scene, lowering the bit rate in said rate converter with respect to other scenes.

7. The recording equipment according to claim 1, wherein:

said controller controls said recorder and reproducer so that recording of a program is conducted at a first bit rate and a second bit rate which is lower than the first bit rate in said rate converter; and

the program recorded at the second bit rate is not reproduced when a special operation is conducted during reproduction of the program recorded at the first bit rate.

8. The recording equipment according to claim 1, wherein said controller conducts control such that, when an original video of an input program is a high definition

television video with a first bit rate, and an original video of an input video signal is a standard definition television video with a second bit rate, the programs are recorded such that the first bit rate is higher than the second bit rate.

9. The recording equipment according to claim 1, further comprising:

decoder which decodes video signal reproduced by said recorder and reproducer; and

display which displays the video signal decoded by said decoder.

10. A recording method for recording a plurality of programs that are input from an external source, comprising the steps of:

storing the past usage information;

inputting a plurality of programs;

acquiring program information of the programs which are input;

analysing the usage tendency of the user based on the past usage information;

determining the compressing rate of recorded video signals based on the acquired program information and the analysed usage tendency; and

recording the video signals based on the determined compressing rate.

11. The recording method according to claim 10, further comprising the steps of:

reproducing the recorded program; and

displaying the reproduced program.

12. The recording method according to claim 10, wherein said acquired program information is acquired via internet.

13. A recording equipment substantially as herein described with reference to and as illustrated in the accompanying drawings.

14. A recording method substantially as any one herein described with reference to the accompanying drawings.



INVESTOR IN PEOPLE

Application No: GB 0311872.6  
Claims searched: 1 - 12

25

Examiner: Robert Barrell  
Date of search: 24 September 2003

## Patents Act 1977 : Search Report under Section 17

### Documents considered to be relevant:

Category	Relevant to claims	Identity of document and passage or figure of particular relevance	
X, Y	X: 1 - 4 & 7 - 11. Y: 5 & 6	JP 2001101797 A	(SANYO) See especially: PAJ abstract and WPI abstract
X	1 & 9 - 11.	EP 1274238 A2	(SAMSUNG) See especially: fig 1; column 3, line 53 - column 4, line 25; and fig 3.
Y	6	EP 1001632 A3	(VICTOR COMPANY OF JAPAN) See especially: column 4, para 0016.
Y	5	WO 2002/032141 A3	(KONINKLIJKE PHILIPS) See especially: page 1, line 26 - page 2, line 2.
A		WO 2002/078349 A2	(KONINKLIJKE PHILIPS)
A		US 20020009289 A1	(MORISHITA)

### Categories:

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.

### Field of Search:

Search of GB, EP, WO & US patent documents classified in the following areas of the UKC<sup>v</sup>:

G5R

Worldwide search of patent documents classified in the following areas of the IPC<sup>7</sup>:

G11B, H04N

The following online and other databases have been used in the preparation of this search report :

EPODOC, WPI, JAPIO